

AN EXPLANATION

OF THE

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FIGURE of ANATOMY,

WHEREIN

The *Circulation of the Blood* is made visible, through Glass Veins and Arteries, with the Actions of the *Heart and Lungs*: As also, The *Course of the Blood* from the Mother to the Child, and from the Child to the Mother: By which Means any Person, tho' unskilled in the Knowledge of ANATOMY, may at one View be acquainted with the *Circulation of the Blood*, and in what Manner it is performed in our living Bodies.

Adorned with a Copper-Plate.

Wherein

The Structure of the *Heart* is design'd, and the Glass Vessels exactly represented in their Order, as they are in the Figure to which they are to be referred.



LONDON: Printed in the Year 1737.

EXPLANATION

OF THE

FIGURE of ANATOMY

WHEREIN

Animadversion.

AS this Figure is chiefly calculated to demonstrate the Circulation of the Blood, with the Actions of the Heart and Lungs, and the Nourishment of the Child while in the Womb, it was absolutely necessary that it should represent a Woman, supposed to be opened when alive; because these are all vital Functions, which are not exercised in a Body when dead: Therefore it is to be hoped that nobody will make objection to this Representation, which would carry with it an Idea of the highest Barbarity and Cruelty, had it ever been put in Practice upon any Humane Body.

The Structure of the Heart is design'd

and the Glass Vessels exactly represented in their Order, as they are in the Figure to which they are to be referred.





Description of the Figure.



HIS Figure represents a Woman gone eight Months, with Child, chained down upon a Table, supposed to be open'd alive, of which the two principal Cavities are laid open, *viz.* the Breast and the lower Belly, which are divided from each other by the Diaphragm or Midriff. In the Breast, the Heart which is placed to move for carrying on the Circulation is seen between the two Lobes of the Lungs, which likewise move as in Breathing; from the Heart are seen going out the two principal Arteries of the Body made of Glass; the one leading to the Lungs, and the other towards every Part of the Body, *viz.* towards the Head and Arms, whilst the Trunk is continued on the Back Bones through the Breast, and passing the Diaphragm into the lower Belly, divides itself to all its Parts, and then goes to the Legs. The same Number of Veins made of Glass accompany the Arteries, join in one Trunk, and open into the Heart again: Through the Arteries a red Liquor, in imitation of Blood, is seen to move from the Heart to every Part of the Body, and

by the Veins returning from every Part of the Body to the Heart again. In the lower Belly, in a Cavity called the *Pelvis* or *Bason*, the Child is seen in the Womb, with the After-birth and Navel-string made of Glass, consisting of two Arteries and one Vein arising from the After-birth by many Branches, which terminate in one of a considerable Length, and enter the Navel of the Child, through which the Blood is seen to pass, from the Mother for its Nourishment. The two Arteries are likewise seen to arise out of the Navel of the Child, twisted round the Vein in its Course towards the After-birth, where it divides itself into a great Number of Branches, in the same Manner as the Vein: Thro' these Arteries the Blood is likewise seen to return from the Child to the Mother after Nourishment.

Of the Structure of the Heart and Lungs, and of the Circulation of the Blood.

IN order to have a right Understanding of the Circulation of the Blood, it is first necessary to be acquainted with the Structure of the Heart and Lungs; because they are the Organs immediately concerned in carrying on that important Function.

Of the Heart.

The Heart is a self-moving Muscle of a pyramidal Figure, suspended (in the Middle of the Breast between the two Lobes of the Lungs) by its principal Vessels being connected to no other Part for the Convenience of its Motions. Of the Heart

we may consider the two Extremities, the one is uppermost and broad, call'd the Base; the other is lowermost, and contracting itself narrow becomes a little sharp, and is called its Point. This more so in Brutes. The Situation of the Heart in Man is resting on the Diaphragm, slanting much towards the left Side, so that the greater Part of it is placed under the left Breast.

It consists chiefly of four principal Cavities, two of which are called Auricles, or Ears, from their Figure, placed on the right and left Sides of the Base of the Heart; the two other are the Ventricles, which are Cavities formed immediately in the Substance of the Heart. The one is the right Ventricle and the other the left. The right Ear opens into the right Ventricle, and the left Ear into the left Ventricle. The Heart like all other Muscles, is made up of a great Number of Fibres or fleshy Threads, disposed in a particular Manner, on the inside of the Ears, where they form a kind of irregular Network, and in the Ventricles, besides this Network, several considerable Eminences called Pillars. The right Ear opens into the right Ventricle, and the left into the left Ventricle; at the Entrance of the right Ear into the right Ventricle there are placed three Valves, which open from the right Ear into the right Ventricle; but close the Return from that Ventricle into that Ear: From the left Ear into the left Ventricle there are placed two more, in the same manner as in the right Ventricle.

There are four principal Vessels which come into and go out of the Heart; two Veins and two Arteries; the two Veins are the *Vena Cava*; or hollow Vein, which is made from the

Union of all the Veins of the Body, and the Pulmonary Vein, made from the Union of all the Veins of the Lungs. The *Vena Cava* opens into the right Ear, and the Pulmonary Vein into the left. The two Arteries are, the Pulmonary Artery, which divides itself into every Part of the Lungs; and the *Aorta magna*, or great Artery, which divides itself into every Part of the Body; the Pulmonary Artery arises out of the right Ventricle, at the Beginning of which there are placed three Valves in the Figure of a Half-moon, which open from the Ventricle into this Artery, but close from the Artery into the Ventricle; the *Aorta magna*, or great Artery, arises out of the left Ventricle, at the Entrance of which there are placed three other Valves of the Half-moon Form, disposed in the same Manner as those in the Pulmonary Artery. Besides these principal Vessels, there are two Arteries and a Vein appropriated to the Use of the Heart; the Arteries are call'd Coronary; they arise from the great Artery at its going out of the Heart, and are distributed throughout the whole Substance of the Heart for its Nourishment; and the Veins bear the same Name which return the Blood into the right Ear.

Of the Lungs.

The Lungs are two in Number, situate on each Side of the Heart, of an elastick spongy Texture: They are connected to the Vessels of the Heart and Windpipe, of which they are chiefly compos'd. The Windpipe is the Passage for Air into the Lungs only; its upper Part is made up of fine small Cartilages,

ridges, of Gristles, four of which form its Entrance, which is at the Root of the Tongue, before the Entrance of the Gullet, and is the Passage for the Aliments. The Fifth is a cartilaginous Valve placed at the Entrance of the Windpipe, which is pressed down at the Time the Aliments are passing into the Gullet. The Windpipe is composed of many cartilaginous Rings, loosely connected to each other, in such a Manner that they may draw one in another: It is placed in the Fore-part of the Neck, and, after its Entrance into the Breast, divides itself into two Branches, whereof the one enters the right Lobe of the Lungs, and the other the left: These Branches divide themselves throughout the whole Structure of the Lungs, and every where terminate in small Vesicles or Bladders, which are all tied together by a Number of small Productions, from the common Covering of the Lungs. The next Vessels are the Pulmonary Arteries and Veins: The Pulmonary Artery divides itself above the Heart into two Branches, the one to the right and the other to the left Lobe of the Lungs, where they follow all the Divisions of the Branches of the Windpipe, laying on the Sides of them, and continuing their Course till they have attained to the small Vesicles, where they spread themselves over them in a Number of small capillary Vessels. From these small capillary Arteries on the Vesicles arise the capillary-pulmonary Veins, which uniting themselves from small Branches into large, on the Sides of the Branches of the Windpipe, form one Trunk in the left Ear. As these considerable Vessels conduce nothing to the Nourishment of the Substance of the Lungs (as will more particularly be treated of in describing the Circulation of the Blood in the Child while

in the Womb, there is a particular Artery, for that Use, called the *Bronchial Artery*, and a Vein to return the Blood.

The Fifth is a Car-
iac, and is the Passage for the Aliment. The Windpipe, which
is placed at the Entrance of the Lungs, is the Windpipe, which
is pressed down at the Entrance of the Lungs, and is called the
Trachea.

Of the Circulation of the Blood, and its Use.

From what hath been said of the Structure of the Heart and the Disposition of its Vessels and Valves, placed at the coming in of the Ventricles from the Ears, as well as of those placed at the going out of the Ventricles into the Arteries; if the Action of the Heart be rightly considered, its Use may be easily understood; for the Ears and Ventricles have both of them the Power of contracting and dilating themselves. But neither of these two Actions can happen at the same time both in the Ears and Ventricles, but the Dilatation of the one must succeed the Contraction of the other, for reasons now to be mentioned: For the Blood is always flowing from the *Vena Cava* into the right Ear, and from the Pulmonary Vein into the left, the one from every Part of the Body, and the other from the Lungs. So that the Ears, if rightly considered, are two little Reservoirs always ready to supply the Ventricles with a mensurated Quantity of Blood, lest its Motion should be suffocated by the Weight of too much Blood at one time. As to the Ventricles, they are to receive the Blood from the Ears, in given Quantities, in order to force it out of their Cavities into the Arteries; by the Force of the right Ventricle through the Pulmonary Artery into the Lungs, and by the left through the great Artery into every Part of the Body. When the Ears contract, the Ventricles dilate, because that the Ventricles at that time are receiving the Blood from them; and when the Ventricles contract, the Ears dilate

dilate, because at that time the Blood endeavouring to return into the Auricles from the Ventricle presses against the Valves, and closes them; during which time the Auricles are filling and kept dilated: The Blood in the Ventricle, which cannot return into the Auricles, is forced over the Half-moon Valves into the Pulmonary Artery from the right Ventricle, as well as over those from the left Ventricle into the great Artery, by which Means the Arteries are dilated and filled with Blood. So that the Dilatation of the Arteries succeeds the Contraction of the Ventricle; for no Blood can possibly return from the Arteries into the Ventricle, because the Half-moon Valves shut up the Mouths of those Arteries, whenever the Blood endeavours to return; and this is the Reason of the Pulsation of the Arteries. Hence it plainly appears, that the Use of the Heart is to carry on two Circulations of the whole Mass of Blood at one and the same time: The one from the right Ventricle through the Lungs to the left Ear, and the other from the left Ventricle through every Part of the Body to the right Ear. The Manner in which these Circulations are carry'd on is the next thing to be considered; And first, of that through the Lungs.

The Lungs perform two Actions, that of Inspiration, and that of Expiration; the first is when the Air is taken into the Lungs, and the other is when it is thrust out.

The first Action is performed by the Means of many Muscles which raise the Ribs, and widen the Breast, during which time the Diaphragm, from a Convex Surface towards the Breast, becomes plane; and at the same time the outward Air, being press'd, rushes in at the Nose and Mouth, and passes through all the Branches of the Wind-pipe, which lead

to the small Vesicles by which they are blown up. The Rings which compose the Branches of the Wind-pipe, which before were contracted one within another, are now extended the one from the other; the Branches of the Pulmonary Artery and Vein laying on the Sides of the Branches of the Wind-pipe, must of necessity be co-equally extended with them, which before lay in Folds, gives now to the Blood a free Opportunity to pass from the right Ventricle of the Heart, through all the Ramifications of the Pulmonary Artery, and fill their Capillaries, which are distributed on the Vesicles: By this time the Elevation of the Ribs ceases, and the antagonist Muscles pull them down, assisted by the weight of the external Air, which presses on their Surface, drives the Air violently out of the Vesicles, through all the Branches of the Wind-pipe; and their Sides being brought together, the Blood contained in the Capillary Arteries by this great Pressure is broken, and its Globules grown so small, as to be able to pass in the Capillary Veins, which are the Pulmonary Veins, from whence it is propelled by the continual Contraction of the Lungs into the left Auricle of the Heart.

Hence we find the great Necessity of Respiration; for by the Blood in its Passage through the Lungs undergoes a violent Triruration, breaking the Texture of its Globules to separate its Parts, by which Means they become dissimilar to each other, and prepare a sufficient Quantity of different Particles for the Nourishment of the different Parts of the Body, which is carried on by the second Circulation from the left Ventricle of the Heart through the *Aorta magna*, or great Artery.

The left Ventricle of the Heart has its Sides about four times as thick as the right; and necessary it was, it should be

be so; a greater Force being required to drive the Blood through the great Artery into every Part of the Body, than through the Lungs only, which is the Use of the right Ventricle.

The *Aorta magna*, or great Artery, is an elastick cartilaginous Tube arising out of the left Ventricle of the Heart, and divides itself to every Part of the Body, the Branches of which continue their Division till they become so small as to be as fine as a Hair, and are call'd Capillaries: From these small Capillary Arteries arise another Kind of small Vessels, which are call'd Veins, which frequently unite into larger Branches from every Part of the Body, till they have formed one common great Trunk, call'd the *Vena Cava*, or great hollow Vein, which opens itself into the right Ear of the Heart. The Blood, which has been sufficiently ground and subtilized by the Action of the Lungs, as was now mentioned, is brought into the left Ear by the Pulmonary Veins. The Cavity of each Ear is capable of containing one Ounce of Blood, so that whenever the left Ear contracts, the great Artery must receive one Ounce of Blood, because the left Ventricle can throw no more Blood into the great Artery, than what it receives from its Ear. During the Time the great Artery is receiving this Quantity of Blood from the contracting Ventricle, it is much dilated or stretched: But as its Substance is indued with a great Spring, as soon as the Resistance is taken off, which is, when the left Ventricle dilates to receive a fresh Quantity of Blood from the left Ear, then the Artery contracts itself, by which Means the Blood is crowded into its Cavity, and closely embraced and pressed against its Sides; the Blood at the same Time equally resisting every Way, presses

against the Half-moon Valves, and prevents its Return into the left Ventricle, and thus is obliged to pass on thro' all the Ramifications of this Artery into every Part of the Body.

During the Time that the Artery is contracting to propel the Blood into every Part of the Body, the left Ventricle is dilating to receive another Quantity of Blood from the left Ear, in order to throw it into the great Artery again, by the Time that the Contraction of its Sides are over.

Thus by the alternate Dilatation and Contraction of the left Auricle and left Ventricle, the Blood, which returns from the Lungs, where it has been attenuated and rendered fit for the Nourishment of the different Parts of the Body, is sent by the great Artery to be distributed to them, whilst the excrementitious Parts are strained off by particular Glands, and carried out of the Body by Sweat and other Evacuations. The remaining Part of the Blood, which has not been sufficiently ground by the Action of the Lungs, is taken up by the Veins, and brought back to the *Cava*, to be poured by the right Auricle into the right Ventricle, in order to be forced through the Lungs again, and there to undergo another Trituration, and afterwards to be distributed to every Part of the Body again, in the Manner it has already been described.

Of the Nourishment of the Child in the Womb.

During the Time that the Child is in the Womb, it is nourished with Blood only, brought to it from the *Placenta*, or After-birth, through the Navel by the umbilical Rope or Navel-string, but as there is always more Blood conveyed to it than is necessary for its Nourishment, there is a constant Return of this Blood through the Navel-string to the After-birth again.

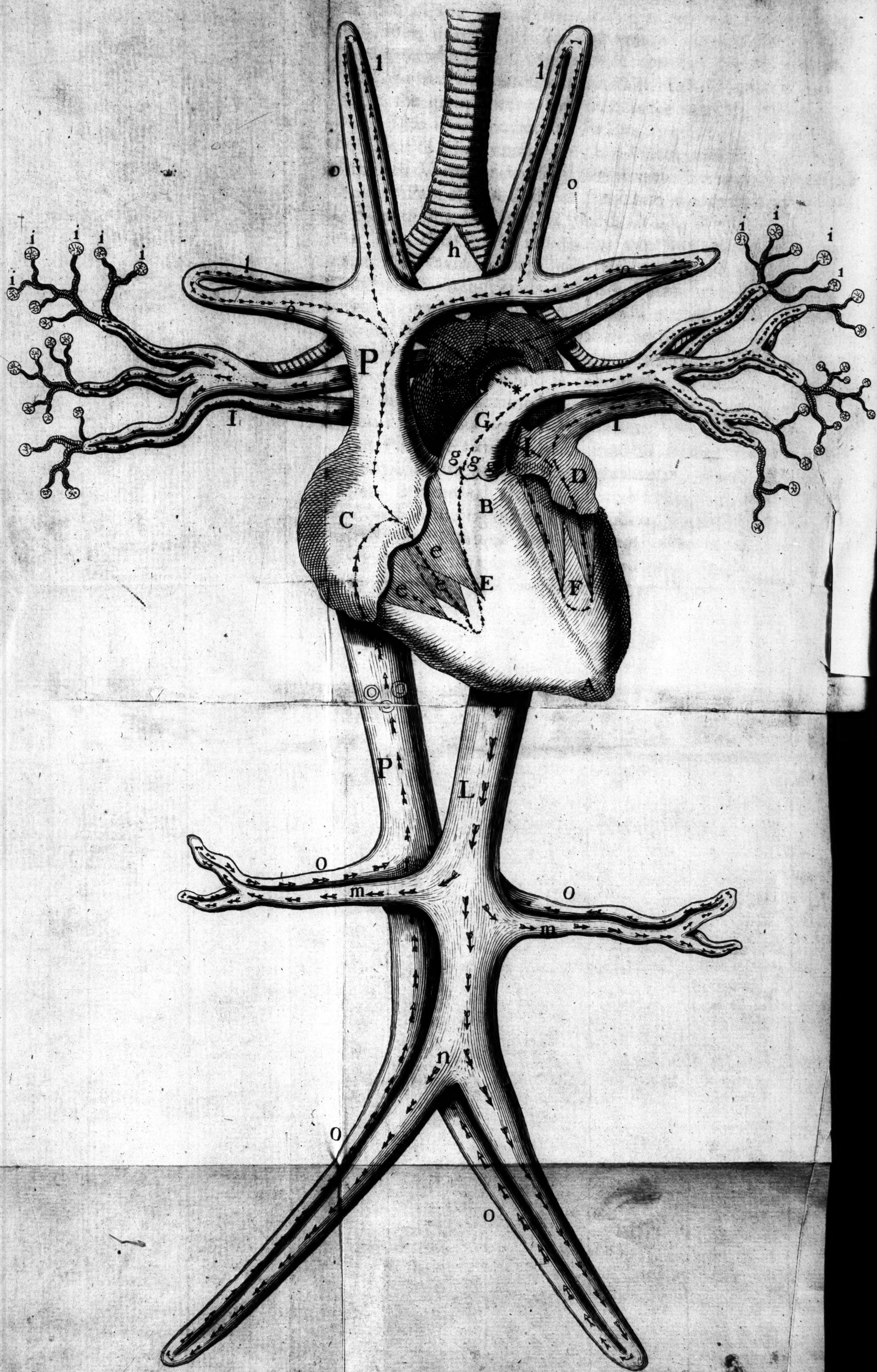
Therefore to have a right Understanding in what Manner this reciprocal Circulation is carried on, it is necessary to consider the Child, during the Time it is in the Womb, to be precluded from all Communication with the outward Air, and cannot breathe, all the Vesicles or little Bladders of its Lungs being closely pressed together, and the Extremities of the Pulmonary Arteries and Veins equally pressed with them, so that the Course of the Blood through the Lungs is entirely stopp'd till Birth; and notwithstanding that the Circulation of the Blood may be conveniently carried on (there are particular Passages left open) without ever passing thro' the Lungs.

The first of these Passages is called *Foramen Ovale*, which is an oval Hole opening from the right Ear of the Heart into the left, where there is a Valve shutting from the left Ear into the right. The second is a Canal of Communication, called *Ductus arteriosus*, which from the Trunk of the Pulmonary Artery opens into the Trunk of the *aorta magna*, or great Artery. The *Placenta*, nor, After-birth, is a large Mass of Blood Vessels like a Cake, composed of Arteries and Veins, by the Extremities of which it is fastened to the inward Surface of the Womb, so that the Extremities of the Arteries of the Womb are joined to those of the Veins of the *Placenta*, and the Extremities of the Arteries of the *Placenta* to those of the Veins of the Womb, by which Means the maternal Blood, by the Arteries of the Womb, is transmitted into the Veins of the *Placenta*, which Veins unite into one considerable one in the middle of the *Placenta*, about an Ell long, which enters the Navel of the Child, passing through the Fissure of the Liver, and opens

opens in the *Vena Cava*, to bring the Blood in the right Ear; one Part of this Blood passes through the *Fornix Ovale*, or oval Hole, into the left Ear; the two Ears contracting themselves force the Blood in the right and left Ventricle of the Heart, so that the Blood contained in the left Ventricle is forced up the great Artery, and that in the right up the Pulmonary: This Blood finding no Passage through the Lungs passes the Canal of Communication, and mixes itself with the Blood of the left Ventricle in the great Artery, by which it is sent to every Part of the Body of the Child for its Nourishment. The remaining Quantity of Blood, which is not employed in nourishing the Child, returns by two Arteries, which come out at the Navel of the Child, and are convoluted about the Vein, which three Vessels compose the Navel-string. The Arteries, having reached the After-birth, divide into an infinite Number of Ramifications, whose smallest Branches unload themselves of their Blood into the Veins of the Womb of the Mother. Thus the Child is continually nourished during the Time that it is contained in the Womb, and the Circulation carried on without ever passing through the Lungs.

But after the Child is born, the Air finding a Passage into its Lungs, blows up all the Vesicles; by which Means the Pressure is taken off from the Blood-Vessels; at which Time, the Blood in the right Ventricle finding a free Passage through the Pulmonary Artery into the Lungs, passes no more through the Duct of Communication, but returns, by the Pulmonary Vein, into the Left, and beating against the Valve of the *Fornix Ovale* for ever closes it up.

EXPLA-



EXPLANATION of the FIGURE

Shews the GLASSES with the Heart and Windpipe,

As they are ranged in the Figure.

A The Point of the Heart.

B its Base.

C The right Ear.

D The left Ear.

E The right Ventricle.

eee Three Valves.

F The left Ventricle.

ff Two Valves.

H The Windpipe.

h its Division.

iiii Some few of the Vesicles at the End of the Branches of the Windpipe.

G The Pulmonary Artery.

ggg Three Valves.

* its Division to the Lungs.

II The Pulmonary Veins, their Union into the left Ear.

K The Aorta, or great Artery.

llll Its Division to the Head and Arms.

L The Trunk of the great Artery contained downwards.

mm Branches to the Kidney.

n Division of the great Artery to the Legs.

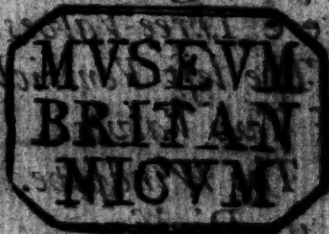
oooo The Veins returning from every part of the Body into

P P the Vena Cava, or great Trunk, where all the Veins unite in the right Ear.

Note,

The *Darts* represent the Course of the Blood circulating through the Heart and Lungs, as well as to and from every Part of the Body. Where the Points of the *Darts* are directed from the Heart, they shew the Course of the Blood in the Arteries; and where they are directed to the Heart, they shew the Course of the Blood in the Veins.

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